2014 Building Envelope

ASHRAE 90.1 Requirements

Florida Building Code, Energy Conservation
5th Edition (2014)
for Commercial Applications

Presented by
The Florida Home Builders Association
and the
Building Officials Association of Florida
Provider #0004764

Rules for the Day

- **Cell phones OFF or on vibrate.**
- You **MUST** be here to get credit; maximum out of class time permitted is 10 minutes per hour
- Leave your CEU certificate with the room monitor
- Please **DO NOT** read the paper or use your laptop for any purpose other than this training program.

BUILDING ENERGY CODES UNIVERSITY

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

ANSI/ASHRAE/IES
Standard 90.1-2010 Envelope

BUILDING TECHNOLOGIES PROGRAM

April 2011 – PNNL-SA-80142

Rules for the Day

- Be respectful of others
- Keep the chatter down
- **Be sure** you have signed the sign-in sheet

Most Important Rule

Don't throw anything at the instructor !

Training Presented as
a Result of a Grant from:
Florida Department of Business and Professional Regulation
to Building a Safer Florida, Inc.

COURSE OBJECTIVES

- Recall the History of the ASHRAE 90.1 in the Florida Building Code and how it has shifted for the 5th edition.
- List the compliance paths found in ASHRAE 90.1 (as they apply to building envelope provisions)
- Delineate where to find important building envelope provisions in the text

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ASHRAE 90.1 in Florida

- Served as model code since 1979
- Energy Policy Act of 1992
  - "Such certification shall include a demonstration that such State's code provisions meet or exceed the requirements of ASHRAE Standard 90.1-1989 (or any successor standard).
- FS 553.73
  - When updating the Florida Building Code…the commission shall select the most current version of the International Energy Conservation Code (IECC) as a foundation code

Structure of ASHRAE 90.1-2010

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Grouped by Building System Provisions
Organized sequentially in each chapter

- Section 1 - Purpose
- Section 2 - Scope
- Section 3 - Definitions, Abbreviations, and Acronyms
- Section 4 - Administration and Enforcement
- Section 5 - Building Envelope
- Section 6 - Heating, Ventilating, and Air Conditioning
- Section 7 - Service Water Heating
- Section 8 - Power
- Section 9 - Lighting
- Section 10 - Other Equipment
- Section 11 - Energy Cost Budget Method
- Section 12 - Normative References

ASHRAE Reference

- Florida Building Code, Energy Conservation, Version 5th edition
- C.401.2 Application. Commercial buildings shall comply with one of the following:
  - 1. *The requirements of ANSIASHRAE/IESNA 90.1.*
  - 2. The requirements of Sections C402, C403, C404 and C405.
  - 3. The requirements of Section C407, C402.4, C403.2, C404, C405.2, C405.3, C405.4, C405.6 and C405.7
- First time Adopted In WHOLE in Florida

Structure of ASHRAE 90.1-2010

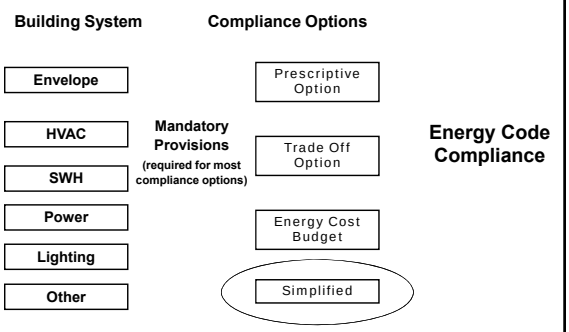
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Grouped by Building System Provisions
Organized sequentially in each chapter

- Section 5 - Building Envelope
- X.1 Scope
- X.2 Compliance Paths
- X.3 Simplified Building
  X.4 Mandatory Provisions
- X.5 Prescriptive
  X.6 Trade-Off
  X.7 Submittals
- X.8 Product Info and Installation Requirement

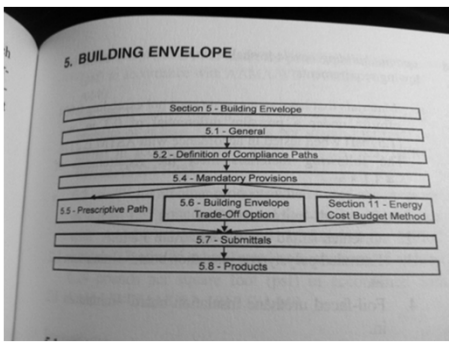
Compliance Approach
Building Envelope

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



In text

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy


5. BUILDING ENVELOPE
Section 5 - Building Envelope
5.1 - General
5.2 - Definition of Compliance Paths
5.4 - Mandatory Provisions
5.5 - Prescriptive Path
5.6 - Building Envelope Trade-Off Option
Section 11 - Energy Cost Budget Method
5.7 - Submittals
5.8 - Products

Compliance Approach
Building Envelope

Energy Efficiency & Renewable Energy

Building System	Compliance Options
Envelope	Prescriptive Option
HVAC	Trade Off Option
SWH	Energy Cost Budget
Power	Simplified
Lighting	
Other	

Mandatory Provisions (required for most compliance options)

What section? Section 5.4

Energy Code Compliance

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Section 5 – 5.4
Mandatory Provisions

Energy Efficiency & Renewable Energy

Insulation references Specific Prescriptive path
All reasonably the *same as FBC-ES*

- ✓ Labeling *(Section 5.8.1.1)*
- ✓ Substantial Contact *(Section 5.8.1.5)*
- ✓ Recessed Equipment *(Section 5.8.1.6)*
- ✓ Insulation Protection *(Section 5.8.1.7)*
- ✓ Insulation Above Suspended Ceilings *(Section 5.8.1.8)*
- ✓ Joints in Rigid Insulation (Section 5.8.1.10)

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Section 5 – 5.1.2
Building Envelope Scope

Energy Efficiency & Renewable Energy

Envelope components that enclose
- ✓ Conditioned space
- ✓ Semiheated space
  - Has a heating system with a capacity > 3.4 Btu/h·ft² of floor area but is not conditioned space

Requirements apply to three space conditioning categories
- ✓ Nonresidential
- ✓ Residential
- ✓ Semiheated Not Florida Applicable?

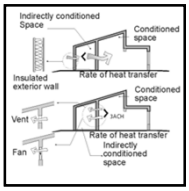

Figure 5-A
Examples of Indirectly Conditioned Spaces
(User's Manual – 90.1.-2010)

5.1.2.4 In climate zones 3 through 8, a space may be designated as either semiheated or unconditioned only if approved by the building official

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Section 5 – 5.4.3
Air Leakage

Energy Efficiency & Renewable Energy

- Fenestration adds ASTM E283
- Requires continuous air barrier, with a better definition

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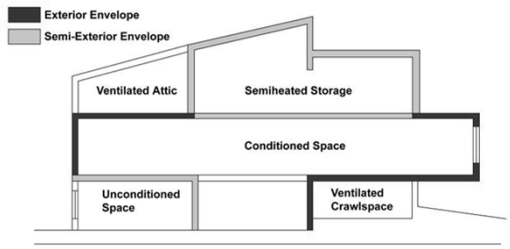
Section 5
Building Envelope

Energy Efficiency & Renewable Energy



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Section 5 – 5.4.3.1
Air Leakage – Continuous Air Barrier

Energy Efficiency & Renewable Energy

Continuous air barrier required except in:
- Semiheated spaces in climate zones 1-6
- Single wythe concrete masonry buildings in climate zone 2B
- Plans
  - Air barrier components identified or noted in construction documents
  - Joints, intersections, and penetrations of air barrier components (incl. lighting fixtures) detailed
- To extend over all surfaces of building envelope
  - At lowest floor, exterior walls, and ceiling or roof
- Designed to resist positive and negative pressures
  - Wind, stack effect, and mechanical ventilation

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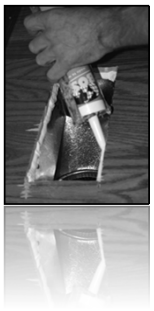
Section 5 – 5.4.3.1.2
Air Leakage – Air Barrier Installation

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

These areas to be wrapped, sealed, caulked, gasketed, or taped
- Joints around fenestration and door frames (both manufactured and site-built)
- Junctions between walls
  - And foundations
  - At building corners
  - And roofs or ceilings
- Penetrations for roofs, walls, and floors
- Building assemblies used as ducts or plenums
- Joints, seams, connections between planes, and other changes in air barrier materials



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What's old on Existing Buildings

- 30% rule on renovated buildings
  - ❖< 30% of assessed valued ≠ the energy code F.S. §553.906
  - ❖DCA staff attorney opinion from 1980s
  - ❖Renovated buildings = any work on existing buildings
    - Remodels, replacements, gut rehabs, change of use and occupancy

Additions & Alterations

- 4.2.1.2 Additions
  4.2.1.3 Alterations
- Shall comply with:
  - Prescriptive Sections 5, 6,7,8, 9 and 10 or
  - Whole building - Section 11
- Same idea as FBC-ES but somewhat different provisions depending on zone

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What's current on Existing Buildings

- 30% rule not applicable to components?
  - New law provided FBC with authority to regulate components and systems as they saw fit - FS §553.903
  - 2010 FEC applied to replacement fenestration (Note: not repair)
  - Current FBC staff attorney ruled that previous attorney had exceed authority
  - Only building officials or legislature could interpret
  - Most CBOs still hold to 30% rule

Section 5.1.3
Envelope Alteration Exceptions

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Allowed if they don't increase energy usage of building

- ✓ Installation of storm windows
- ✓ Replacement of glazing in existing sash and frame
- ✓ Alterations to envelope cavities provided they are insulated to full depth with a nominal R-3.0 per in.
- ✓ Roof and floor alterations where no new cavities are created

  FBC – roofs where sheathings nor insulation is exposed CE101.4.3
- ✓ Replacement of roof membranes
- ✓ Replacement of existing doors
- ✓ Replacement of existing fenestration, provided area of replacement is no more than 25% of total fenestration area

  FBC – All replacement Fenestration must meet prescriptive requirements CE101.4.7

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What's new for 5th Edition

- The table explaining the 30% rule is deleted
- Renovated buildings ≠ components
- Fenestration = components
  - Also applies to ASHRAE because component language is statutory reference
- Must meet Prescriptive requirements of FBC
  - C101.4.7 New products shall meet the minimum efficiencies allows by this code for the following systems and components:

    …Replacement fenestration

FBC-EC window requirements

FBC-EC, 5th		Zone 1 U/SHGC			Zone 2	
Windows						
Fixed		0.5/0.25			0.5/0.25	
Operable		0.65/0.25			0.65/0.25	

- Also requires labeling
- C303.1.3 NFRC 100 for U-factor, NFRC 200 for SHGC, or default for unlabeled (which don't meet FBC requirement)
- For curtainwalls and storefront, this would require a CMA certificate (Component Modeling Approach) http://www.nfrc.org/CMA/Default.aspx

Window Replacement Pros and Cons

FBC-EC, 5th		Zone 1 U/SHGC			Zone 2	
Windows						
Fixed		0.5/0.25			0.5/0.25	
Operable		0.65/0.25			0.65/0.25	
ASHRAE Glass area	**<25%**	**Zone 1 U/SHGC 25-40%**	**>40%**	**<25%**	**Zone 2 U/SHGC 25-40%**	**>40%**
Non-metal framing	na	1.2/0.25	ECB		0.75/.025	ECB
Metal framing						
Curtainwall & Storefront	na	1.2/0.25	ECB		0.7/0.25	ECB
Other (not entrance doors)	na	1.2/0.25	ECB		0.75/.25	ECB

*ASHRAE semi-heated has no SHGC requirement

ASHRAE Window requirements

ASHRAE	<25%	Zone 1 U/SHGC 25-40%	>40%	<25%	Zone 2 U/SHGC 25-40%	>40%
Non-metal framing	na	1.2/0.25	ECB		0.75/.025	ECB
Metal framing						
Curtainwall & Storefront	na	1.2/0.25	ECB		0.7/0.25	ECB
Other (not entrance doors)	na	1.2/0.25	ECB		0.75/.25	ECB

*ASHRAE semi-heated has no SHGC requirement

- Also cites NFRC 100 & 200
- Defaults are more liberal
- Can also take a Center of Glass value from manufacturer for SHGC

Section 5 – 5.5.3.1
High Albedo Roofs

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Required in climate zones 1-3

Minimum three-year aged solar reflectance of 0.55 and minimum three-year aged thermal emittance of 0.75

OR

Minimum Solar Reflective Index of 64

- Solar Reflectance Index must be as calculated by the ASTM E1980 procedure.

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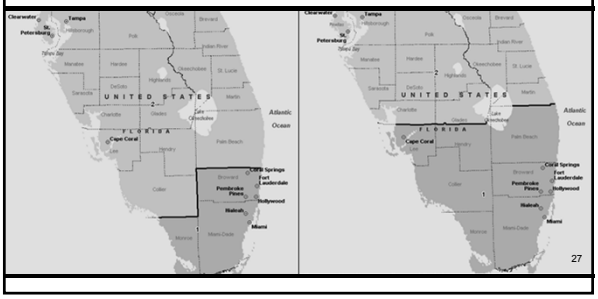
It gets more complicated in Palm Beach, Lee, Henry and Collier

2010 FEC & ASHRAE 90.1-2010 2014 FBC-EC, v5



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Section 5 – 5.5.3.1
High Albedo Roofs - Exceptions

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- Ballasted roofs with minimum stone ballast of 17 lbs/ft2 or 23 lbs/ft2 pavers
- Vegetated roof systems containing minimum thickness of 2.5 in. of growing medium that covers minimum of 75% of roof area with durable plantings
- Roofs, where a minimum of 75% of the roof area is:
  1. shaded during peak sun angle on June 21 by permanent components or features of the building **OR**
  2. covered by off-set PV arrays, building-integrated PV arrays, or solar air or water collectors **OR**
  3. permitted to be interpolated using a combination of parts 1 and 2 above
- Steep sloped roofs
- Low sloped metal building roofs in climate zones 2-3
- Roofs over: ventilated attics, or semiheated spaces, or conditioned spaces that aren't cooled spaces
- Asphaltic membranes in climate zones 2-3

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Section 5
High Albedo Roof - *Example*

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VOLUNTARY: LEARNING OBJECTIVES REVISITED

2014 Building Envelope ASHRAE 90.1 Requirements
Florida Building Code, Energy Conservation 5th Edition (2014)
for Commercial Applications

LEARNING OBJECTIVES REVISITED: QUIZ

Question 1: Which Section contains mandatory requirements? Where can I check?

Question 2: Which path can NOT be used for building envelope compliance?

a. Prescriptive
b. Simplified
c. Trade-Off
d. Energy Cost Budget

Question 3: Name the base code Florida has used since 1979? How can it be used in the 5th Edition?

Florida Home Builders Association

HVAC requirements in ASHRAE 90.1

Florida Building Code, Energy Conservation
5th Edition (2014)
for Light Commercial Applications

Building A Safer Florida, Inc.

Presented by
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Provider #0004764

Florida Department of Business & Professional Regulation

BUILDING ENERGY CODES PROGRAM

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

ANSI/ASHRAE/IES
Standard 90.1-2010 HVAC for
Light Commercial Construction

PNNL-SA-80143

Training Presented as
a Result of a Grant from:
Florida Department of Business and
Professional Regulation
to Building a Safer Florida, Inc.

Florida Department of Business & Professional Regulation

Building A Safer Florida, Inc.

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Most Important Rule

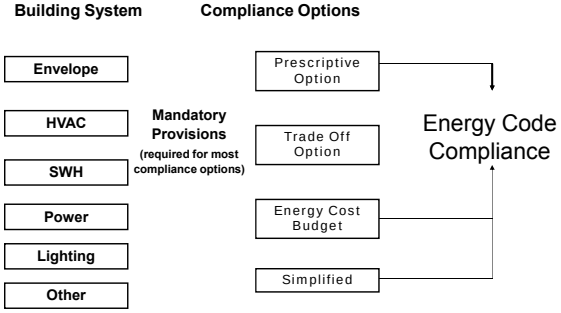
Don't throw anything at the instructor !

Course Objectives

- List the compliance paths that can be applied to HVAC provisions
- List three mandatory provisions that apply to all HVAC paths
- List three important provisions for each of the HVAC paths as they may apply to light commercial construction

6

HVAC Compliance



Structure of ASHRAE 90.1-2010

Grouped by Building System Provisions
Organized sequentially in each chapter

- Section 1 - Purpose
- Section 2 - Scope
- Section 3 - Definitions, Abbreviations, and Acronyms
- Section 4 - Administration and Enforcement
- Section 5 - Building Envelope
- Section 6 - Heating, Ventilating, and Air Conditioning
- Section 7 - Service Water Heating
- Section 8 - Power
- Section 9 - Lighting
- Section 10 - Other Equipment
- Section 11 - Energy Cost Budget Method
- Section 12 - Normative References

Structure of ASHRAE 90.1-2010

Grouped by Building System Provisions
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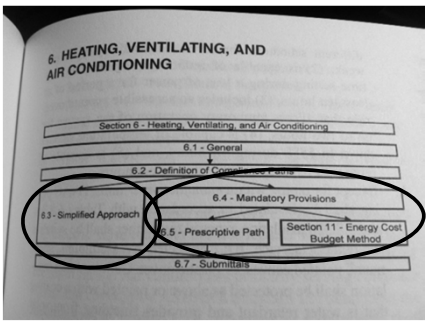
- Section 6 HVAC
- X.1 Scope
- X.2 Compliance Paths
- X.3 Simplified Building
  X.4 Mandatory Provisions
- X.5 Prescriptive
  X.6 Trade-Off
  X.7 Submittals
- X.8 Product Info and Installation Requirement

In text


6. HEATING, VENTILATING, AND AIR CONDITIONING
Section 6 - Heating, Ventilating, and Air Conditioning
6.1 - General
6.3 - Simplified Approach
6.4 - Mandatory Provisions
6.5 - Prescriptive Path
Section 11 - Energy Cost Budget Method
6.7 - Submittals

ASHRAE HVAC

- There are three compliance paths
- Prescriptive and ECB is the same approach as in 5th Edition
- There is no Trade Off
- Simplified is unique to ASHRAE
  - Does not have Mandatory requirements
  - Path has its own Must Do requirements

Why simplified?

- small buildings
  - 80 to 85% of the building stock
- minimal effort, same stringency
- Simplified is unique to ASHRAE
  - Some Mandatory requirements
  - Some unique requirements

Section 6 – 6.3.2
Simplified Approach Option

The simplified approach is an optional path for compliance when the following are met:

- ✓ Buildings with 1 or 2 stories
- ✓ Buildings with gross floor area < 25,000 ft²
- ✓ Single zone HVAC Systems
- ✓ Each HVAC system must comply with the list of requirements

Pre-requisite

Is this the answer to Shell Building Conundrum?

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What about Shell buildings?

- Shell building path deleted
- Issue: What happens on build out if traded off on original submittal?
- Answer: Depends on code and method
  - Semi-heated spaces can screw stuff up
- If ECB, then HVAC Building ↑ Envelope↓
  - More expensive for tenant on build out
- If Trade Off, then can use Simplified HVAC
  - Variability without HVAC penalty

Light Commercial Construction - DOE

- DOE defines "light commercial construction" as having the following characteristics
  - Less than 50,000 square feet
  - Limited participation by architectural and engineering firms
  - Use of standard details and specifications with little use of integrated design techniques
  - Use of prescriptive compliance paths
  - Typically only one or a few stories
  - Zone control for space conditioning is accomplished with unitary heating, ventilating, and air conditioning (HVAC) equipment rather than built-up applied systems

"Light Commercial Building Flexible Research Platforms", ORNL 2012, http://btric.ornl.gov/publications/ORNL%20Report_Light%20Commercial%20Building%20Flexible%20Research%20Platforms.pdf

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Light Commercial Construction - ASHRAE

- The term "light commercial construction" is not used in Standard 90.1.
- The closest surrogate is the simplified approach defined for the HVAC chapter, which is the focus of this presentation.
- For buildings that do not meet the requirements of ASHRAE Standard 90.1's simplified approach, see DOE's full set of HVAC training materials at http://www.energycodes.gov/training-courses/ansiashraeies-standard-901-2010.

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Section 6 – 6.2
HVAC Compliance Paths

- ✓ You have to follow Sections
  - 6.1 General,
  - 6.7 Submittals, and
  - 6.8 Minimum Equipment Efficiency
- ✓ And then you can follow either
  - Section 6.3 Simplified Approach OR
  - Sections 6.4 Mandatory Provisions and 6.5 Prescriptive Path
- ✓ Alternatively, you can follow Section 11 (ECB), in which case Section 6.4 is mandatory

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Section 6 – 6.3.2
Simplified Approach Criteria

a. Single HVAC zone
b. Single zone VAV controls (6.4.3.10) similar to 5th edition
c. Cooling equipment efficiency (6.8.1)
d. Air economizers (6.5.1)
e. Heating equipment efficiency (6.8.1)
f. Exhaust air energy recovery (6.5.6.1)
g. Dual setpoint thermostat or manual changeover
h. Heat pump auxiliary heat control
i. No reheat or simultaneous cooling and heating for humidity control
j. Off-hour shutoff and temperature setback/setup
k. Piping insulation (Tables 6.8.3A and 6.8.3B)
l. Ductwork insulation and sealing (6.4.4.2.1) similar to 5th edition
m. Air balancing of ducted system
n. Outdoor air intake and exhaust systems (6.4.3.4) equally different
o. Zone thermostatic controls to prevent simultaneous heating and cooling
p. Optimum start controls
q. Demand control ventilation (6.4.3.9) similar to 5th edition

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Section 6 – 6.4
HVAC Mandatory Provisions

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- ✓ Minimum Equipment Efficiency *(Section 6.4.1)*
- ✓ Calculations *(Section 6.4.2)* — Federal minimums
- ✓ Controls *(Section 6.4.3)*
- ✓ *General, Dead Band, Automatic Shutdown* — *Same as 5th Edition*
- ✓ *Setpoint Overlap Restriction, Automatic shutdown, Optimum start controls and zone isolation* — *Different from 5th edition*
- ✓ HVAC System Construction and Insulation *(Section 6.4.4)*

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Section 6 – 6.1.1.3
HVAC Alterations Scope

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- ✓ Equipment
  - New equipment shall meet the minimum efficiency requirements
- ✓ Cooling systems
  - New cooling systems installed to serve previously uncooled spaces shall comply with this section
  - Alterations to existing cooling systems shall not decrease economizer capacity (unless economizer tradeoff is used)
- ✓ Ductwork
  - New and replacement ductwork shall comply with applicable requirements
- ✓ Piping
  - New and replacement piping shall comply with applicable requirements

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HVAC Compliance

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building System	Compliance Options
Envelope	Prescriptive Option
HVAC	Trade Off Option
SWH	Energy Cost Budget
Power	Simplified
Lighting	
Other	

Mandatory Provisions (required for most compliance options)

Energy Code Compliance

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Section 6 – 6.3.2a
Single Zone HVAC System

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- Single-zone HVAC systems are simpler than multi-zone HVAC systems.
- Requirements for single-zone HVAC systems are simpler than requirements for multi-zone HVAC systems.
- Therefore the Simplified Approach Option only deals with the simpler systems.

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Section 6 – 6.4.3.10 (6.3.2b)
Single Zone VAV Controls

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- ✓ Supply fans controlled by two-speed motors or variable-speed drives
  - Air-handling and fan coil units with chilled-water cooling coils
  - Supply fans with motors ≥ 5 hp
- ✓ At cooling demands ≤ 50%, supply fan controls able to reduce airflow to no greater than the LARGER of
  - ½ of the full fan speed OR
  - volume of outdoor air required to meet Standard 62.1

On and after January 1, 2012

- ✓ Supply fans controlled by two-speed motors or variable speed drives
  - all AC equipment and air-handling units with direct expansion cooling and cooling capacity at AHRI conditions ≥ 110,000 Btu/h serving single zones
- ✓ At control demands
  - 2/3 of the full fan speed OR
  - volume of outdoor air required to meet Standard 62.1

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Section 6 – 6.8.1A (6.3.2c and e)
Equipment Efficiency

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Reference Tables 6.8.1A, 6.81B, 6.8.1.D,
6.8.1E, and 6.8.1F in 90.1-2010
6.8.1A – air conditioners
6.8.1B – heat pumps
6.8.1D – packaged terminal and room air conditioners and heat pumps
6.8.1E – furnaces, duct furnaces, and unit heaters
6.8.1F - boilers

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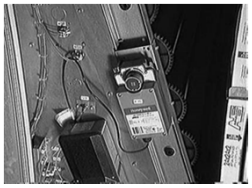
Section 6 – 6.3.2d
Economizers

The system shall have an economizer that meets requirements of Section 6.5.1, unless the economizer Trade-off Option is used

- ✓ Economizer requirement by climate zone and equipment size
- ✓ Trade-off requires higher minimum cooling efficiency (EER, COP, IEER, SEER) by climate zone



25

Section 6 – 6.3.2d
Economizers

Reference Table 6.3.2 in 90.1-2010

- Table 6.3.2 is the table to review for eliminating the required Economizer.
- Trade-offs require an improvement in the efficiency of the cooling equipment above the minimum efficiency of that equipment. Improvements range from 17% in Climate Zone 2A (a relative hot and humid climate zone mostly along the Gulf Coast)
- The more valuable the economizer is in terms of reducing cooling energy usage, the large the efficiency trade-off needed to make eliminate the economizer.

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Section 6 – 6.5.1 (6.3.2d)
Economizers

- ✓ Economizer requirements are climate and size dependent *(Tables 6.5.1A and B)*
- ✓ There are also LOTS of exceptions (show on following slides)
- ✓ Can use air economizers
  - 100% of design supply air
  - Sequenced with mechanical cooling equipment
  - High limit shutoff
  - Dampers

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Section 6 – 6.3.2d
Economizers

- Reference Tables 6.5.1A and 6.5.1B in 90.1-2010
- Table 6.5.1A is the table to review for economizer requirements.
  - As a general, Standard 90.1-2010 requires an economizer for fan-cooling unit sizes greater than 54,000 Btu/h in all climate zones except Climate Zone 1.
- Table 6.5.1B is a separate table specifically for economizer requirements for computer rooms

28

Section 6 – 6.5.1(6.3.2d)
Economizer Exceptions

Exceptions

- ✓ Systems with gas phase air cleaning per Standard 62.1
- ✓ Where >75% of the air must be humidified >35°Fdp
- ✓ Systems with condenser heat recovery per 6.5.6.2.2a or 6.5.6.2.2b
- ✓ Residential systems <5X limits in Table 6.5.1A
- ✓ Systems with a balance point <=60°F
- ✓ Systems expected to operate < 20hrs/wk
- ✓ Systems serving zones with refrigerated casework
- ✓ Where comfort cooling efficiency meets or exceeds Table 6.3.2
- ✓ Systems serving computer rooms under certain conditions

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Section 6 – 6.5.6.1 (6.3.2f)
Exhaust Air Energy Recovery

- Required if:
  - ✓ Supply air capacity ≥ value listed in Table 6.5.6.1
    - Values are based on climate zone and % of outdoor air flow rate at design conditions
- Recovery system effectiveness ≥ 50%
- There are 9 exceptions

30

Section 6 – 6.5.6.1 (6.3.2f)
Exhaust Air Energy Recovery Exceptions

- ✓ Lab systems meeting 6.5.7.2
- ✓ Systems serving uncooled spaces that are heated to < 60°F
- ✓ Systems exhausting toxic, flammable, paint or corrosive fumes or dust
- ✓ Commercial kitchen hoods used for collecting grease or smoke
- ✓ Where > 60% of outdoor heating energy is provided from site-recovered or site solar energy
- ✓ Heating energy recovery in climate zones 1 and 2
- ✓ Cooling energy recovery in climate zones 3c, 4c, 5b, 5c, 6b, 7, and 8
- ✓ Where largest exhaust source is < 75% of the design outdoor airflow
- ✓ Systems requiring dehumidification that employ energy recovery in series with the cooling coil
- ✓ Systems operating < 20 hrs/week at outdoor air % in Table 6.5.6.1

Section 6 – 6.3g-j
Simplified Approach Option *(cont'd)*

g) Manual changeover or dual set-point thermostat
h) Heat pump supplementary heat control
i) No reheat or simultaneous heating and cooling for humidity control
j) Time clocks *(except hotel/motel guest rooms and systems requiring continuous operation)*

Section 6 – 6.3.2k and l
Simplified Approach Option *(cont'd)*

Piping and ductwork/plenum insulated – ducts and plenums sealed

Section 6 – 6.8.3(6.3.2k and l)
Piping Insulation

6.3.2k - Reference Tables 6.8.3A and B in 90.1-2010

6.3.2l - Reference Tables 6.8.2A, 6.8.2B, 6.4.2.2.1 in 90.1-2010

Section 6 – 6.4.4.1.3 (6.3.2k)
Piping Insulation

Exceptions

- ✓ Factory-installed
- ✓ Piping conveying fluids
  - design operating temperature range between 60°F-105°F, inclusive
  - that haven't been heated or cooled through the use of fossil fuels or electricity or where heat gain or heat loss will not increase energy usage
- ✓ Hot water piping between shut off valve and coil, not > 4 ft. in length, when located in conditioned spaces
- ✓ Piping ≤ 1 in.
  - No insulation required for strainers, control values, and balancing values

Section 6 – 6.3m-p
Simplified Approach Option *(cont'd)*

m) Balancing of ducted systems per section 6.4.3.4
n) Outdoor air intake and exhaust systems
o) Interlocked thermostats for separate heating and cooling
p) System > 10,000 cfm:
   m) optimum start controls

Section 6 – 6.4.3.9 (6.3.2q)
Demand Control Ventilation

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DCV must be provided for each zone with a area > 500 ft² and the design occupancy > 40 people/1000 ft² where the HVAC system has:

- ✓ An air-side economizer,
- ✓ Automatic modulating control of the OSA dampers, or
- ✓ A design outdoor airflow > 3,000 cfm

Demand control ventilation (DCV): a ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy.

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Don't Forget Submittals

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- Buildings that comply with the simplified approach for HVAC are not subject to the mandatory and prescriptive HVAC requirements in Sections 6.4 and 6.5 of Standard 90.1-2010.
- However, buildings that comply with the simplified approach are required to comply with Section 6.7 on Submittals and Section 6.8 on Minimum Equipment Efficiency of Standard 90.1-2010.

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Section 6 – 6.7
Submittals

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- ✓ Record drawings
- ✓ Operating and maintenance manuals
- ✓ System balancing
- ~~✓ System commissioning~~ – Not required for simplified approach option

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Section 6 – 6.7.2.1and 6.7.2.2
Drawings and Manuals

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Record drawings of actual installation to building owner within 90 days of system acceptance and include, as a minimum

- ✓ Location and performance data on each piece of equipment
- ✓ General configuration of duct and pipe distribution system including sizes
- ✓ Terminal air or water design flow rates

Operating and maintenance manuals submitted to building owner within 90 days of system acceptance and include several items

40

Section 6 - 6.7.2.3
System Balancing

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- ✓ Systems shall be balanced in accordance with accepted engineering standards
- ✓ Written report for conditioned spaces > 5000 ft²
- ✓ Air systems shall be balanced to minimize throttling losses
- ✓ For fans with system power > 1 hp
  - – Adjust fan speed to meet design flow conditions

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Section 6 – 6.7.2.3.3
Hydronic System Balancing

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Proportionately balanced to minimize throttling losses

Pump impeller trimmed or pump speed adjusted to meet design flow conditions

Each system to have either the ability to measure differential pressure increase across the pump or have test ports at each side of the pump

Exceptions to pump impeller trimmed or pump speed adjusted

- ✓ Pumps with pump motors ≤ 10 hp
- ✓ When throttling results in < 5% of the nameplate hp draw, or 3 hp, whichever is greater, above that required if the impeller was trimmed

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Section 6 – 6.7.2.4
System Commissioning

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

~~Control elements are calibrated, adjusted, and in proper working condition~~

~~> 50,000 ft² conditioned area~~
- ~~✓ Except warehouses and semiheated spaces~~
- ~~✓ Requires commissioning instructions~~

NOT APPLICABLE TO SIMPLIFIED APPROACH OPTION BECAUSE A BUILDING WITH 50,000 FT² of CONDITIONED AREA IS TOO LARGE FOR THIS OPTION.

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BUILDING ENERGY CODES PROGRAM www.energycodes.gov/

VOLUNTARY: LEARNING OBJECTIVES REVISITED

44

Question 1

Which Section contains HVAC requirements?

45

Question 2

Multiple Choice: Which path can NOT be used for building envelope compliance? Why not?

A. Prescriptive
B. Simplified
C. Trade-Off
D. Energy Cost budget

Question 3

Name a simplified provision that overlaps with mandatory one?

Answer:

47

Course Objectives

- List the compliance paths that can be applied to HVAC provisions
- List three mandatory provisions that apply to all HVAC paths
- List three important provisions for each of the HVAC paths as they may apply to light commercial construction

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2014 Advanced Compliance Paths Overview

Florida Building Code, Energy Conservation 5th Edition (2014) for Commercial Applications

Building A Safer Florida, Inc.

Presented by The Florida Home Builders Association and the Building Officials Association of Florida Provider #0004764

Florida Department of Business & Professional Regulation

1

Training Presented as a Result of a Grant from: Florida Department of Business and Professional Regulation to Building a Safer Florida, Inc.

Florida Department of Business & Professional Regulation

Building A Safer Florida, Inc.

2

Rules for the Day

- Cell phones OFF or on vibrate.
- You MUST be here to get credit; maximum out of class time permitted is 10 minutes per hour
- Leave your CEU certificate with the room monitor
- Please DO NOT read the paper or use your laptop for any purpose other than this training program.

3

Rules for the Day

- Be respectful of others
- Keep the chatter down
- Be sure you have signed the sign-in sheet

Most Important Rule

Don't throw anything at the instructor !

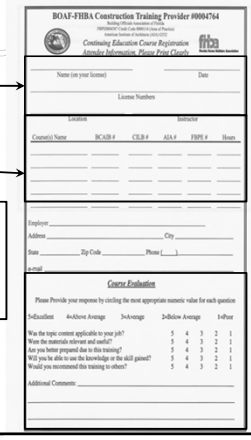
4

BOAF-FHBA CEU Certificate

First Name, Last Name and License number

One Course Per Line

BCAIB:	Building Code Administrators and Inspectors Board
CILB:	Construction Industry Licensing Board
AIA:	Board of Architecture and Interior Design
FBPE:	Florida Board of Professional Engineers


BOAF-FHBA Construction Training Provider #0004764

Continuing Education Course Registration
Attendee Information. Please Print Clearly

Name (on your license) Date

License Number

Location Instructor

Course(s) Name | BCAIB # | CILB # | AIA # | FBPE # | Hours

Employer

Address City

State Zip Code Phone ( )

e-mail

Course Evaluation

Please Provide your response by circling the most appropriate numeric value for each question

5=Excellent 4=Above Average 3=Average 2=Below Average 1=Poor

Was the topic content applicable to your job? 5 4 3 2 1
Were the materials relevant and useful? 5 4 3 2 1
Are you better prepared due to this training? 5 4 3 2 1
Will you be able to use the knowledge or the skill gained? 5 4 3 2 1
Would you recommend this training to others? 5 4 3 2 1

Additional Comments:

5

Course Title: 2014 Advanced Compliance Paths Overview Florida Building Code, Energy Conservation, 5th Edition (2014) for Commercial Applications

Date: **Location:**
Hours: 1.0 hours **Instructors:**

Approval Numbers

Contractors:	CILB #
Building Dept.:	BCAIB #
Engineers:	FBPE
Architects:	AIA #

6

The Basics

- Trainer Introduction
- Training Presenter
- Participant Poll
  - Contractors
  - Trades
  - "Boots on the ground"
  - Enforcement Officials

7

Applicability

- Buildings Other Than:
  - –One- and two-family residential
  - –R-2, R-3, R-4 three stories or less in height
    - R-2 is occupancies containing more than 2 dwelling units where the occupants are primarily permanent in nature, including apartments, boarding houses, dormitories, etc (but not hotels/motels).
    - R-3 includes one- and two-family dwellings.
    - R-4 includes residential care and assisted living facilities.

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BUILDING ENERGY CODES UNIVERSITY

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Many Thanks for providing technical support and slides for this module

PNNL-SA-82405

Applicability

11

from www.energycodes.gov/becu

Effective Date

- Previous Code: 2010 Florida Building Code, Energy Conservation
  - Effective Date: March 15, 2012
- New Code: Florida Building Code, Energy Conservation, 5th Edition (2014)
  - Tentative Effective Date: June 30, 2015
    (as of accreditation date)

One size does not fit all

- Huge variability within Commercial construction
  - Building Types
  - Occupancies
  - Usages
- Commercial Energy Code reflect variability
  - = flexibility
  - ≈ multiple compliance options
  - ≈ confusion

Agenda

- We won't talk about…
  - Specific R-values, U-factors, SEER, EF
  - There is an alternative to almost every rule
  - Common mandatory provisions are covered in separate BOAF/FHBA course
- What we will talk about…
  - What are the Compliance Paths
  - Where to find them
  - How they work
  - How they differ

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Course Objectives

- Demonstrate ability to navigate the 2014 Florida Building Code, Energy Conservation for Commercial Applications
- Delineate how building envelope, mechanical and lighting provisions are grouped to form compliance paths for commercial applications
- Define paths found in the Florida Building Code, Energy Conservation and ASHRAE 90.1

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What's the BIG new for 2015?

- Structure of chapter
- Compliance paths
- Three listed in text
  - Shell building path is gone
- Four additional paths via reference
  - Shift away from ASHRAE as primary *listed* path of Florida Energy Code
- Seven total paths with alot of variations!
- Navigation is NOT trivial

Merriam-Webster definition:
Compliance: conformity in fulfilling official requirements
Path: Route, a way of achieving or doing something

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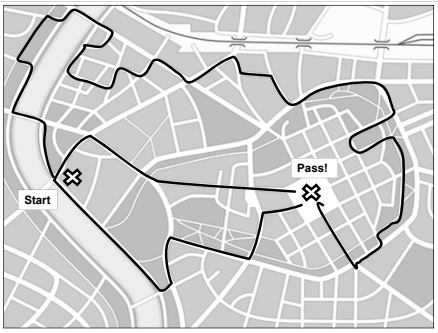
Paths – multiple ways to get from here to there



© Roberto1977 | Dreamstime.com - Nameless City Map Photo

16

What's common?

- Building System Provisions
  - Building Envelope
    - Foundations, roofs, ceilings, fenestrations, walls
  - Mechanical
    - Heating, cooling, service water heating, some plumbing
  - Electrical
    - Lighting/daylighting, controls, power allowances, some wiring

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What's not common?

- How the Building System Provisions fit together
  - Component efficiencies of each system within a path
  - Number of components within each provision, e.g.:
    - Insulation plus framing vs
    - Insulation, framing, cladding and drainage plane air gap

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C401.2 - It's all about the Path…

UPDATED

Florida Building Code, Energy Conservation, 5th Edition

1 ○ ANSI/ASHRAE/ IESNA 90.1-2010

OR

2 ○ C402 - Envelope
○ C403 - Mechanical
○ C404 - SWH
○ C405 - Lighting

AND

○ Pick One:
- C406.2 – Eff. HVAC Performance
- or
- C406.3 – Eff. Lighting Systems
- or
- C406.4 – On-site Renewable Energy

OR

3 ○ C407 – Total Building Performance
○ C402.4 – Air Leakage
○ C403.2 – Provisions applicable to all mechanical systems
○ C404 - SWH
○ Lighting Mandatory Sections
C405.2
C405.3
C405.4
C405.6
C405.7
○ Building energy cost to be ≤ 85% of standard reference design building

Based on IECC 2012

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from www.energycodes.gov/becu

LET'S BREAK IT DOWN…

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C401.2 - It's all about the Path…

UPDATED

Florida Building Code, Energy Conservation, 5th Edition

1 ○ ANSI/ASHRAE/ IESNA 90.1-2010

OR

2 ○ C402 - Envelope
○ C403 - Mechanical
○ C404 - SWH
○ C405 - Lighting

AND

○ Pick One:
- C406.2 – Eff. HVAC Performance
- or
- C406.3 – Eff. Lighting Systems
- or
- C406.4 – On-site Renewable Energy

OR

3 ○ C407 – Total Building Performance
○ C402.4 – Air Leakage
○ C403.2 – Provisions applicable to all mechanical systems
○ C404 - SWH
○ Lighting Mandatory Sections
C405.2
C405.3
C405.4
C405.6
C405.7
○ Building energy cost to be ≤ 85% of standard reference design building

Paths have a Calculation component

Based on IECC 2012

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from www.energycodes.gov/becu

ASHRAE Compliance Reference C401.2

UPDATED

1 ○ ANSI/ASHRAE/ IESNA 90.1-2010

- Base code for Florida since 1977
- Designated as national model commercial code by 1992 Energy Policy Act (federal)
- Heavily amended in Florida prior to 5th edition
- ***5th edition adopts by reference in entirety with no amendments***

C401. Application
Commercial buildings shall comply with one of the following:
1. The requirements of ANSI/ASHRAE/IESNA 90.1.

23

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C401.2 - It's all about the Path…

UPDATED

Florida Building Code, Energy Conservation, 5th Edition

1 ○ ANSI/ASHRAE/ IESNA 90.1-2010

OR

2 ○ C402 - Envelope
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- C406.2 – Eff. HVAC Performance
- or
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3 ○ C407 – Total Building Performance
○ C402.4 – Air Leakage
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○ C404 - SWH
○ Lighting Mandatory Sections
C405.2
C405.3
C405.4
C405.6
C405.7
○ Building energy cost to be ≤ 85% of standard reference design building

Paths have a Calculation component

NEW

SOFTWARE CHOICE IS IMPORTANT!

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ASHRAE 90.1 Compliance Path

Building System

- Envelope
- HVAC
- SWH
- Power
- Lighting
- Other

Mandatory Provisions (required for most compliance options)

Compliance Paths

a Prescriptive Option
b Trade Off Option
c Energy Cost Budget
d Simplified

Energy Code Compliance

from www.energycodes.gov/becu

Structure of ASHRAE 90.1-2010

- Section 1 - Purpose
- Section 2 - Scope
- Section 3 - Definitions, Abbreviations, and Acronyms
- Section 4 - Administration and Enforcement
- Section 5 - Building Envelope
- Section 6 - Heating, Ventilating, and Air Conditioning
- Section 7 - Service Water Heating
- Section 8 - Power
- Section 9 - Lighting
- Section 10 - Other Equipment
- Section 11 - Energy Cost Budget Method
- Section 12 - Normative References

Grouped by Building System Provisions

Except for

25

from www.energycodes.gov/becu

Applications - ASHRAE

1

- Good for highly specialized, large projects
- Very flexible to accommodate complexity
- Anchors green building systems i.e. LEED
- Previously most common for ALL Florida Compliance

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Confused?

- Use standard for checking details
- ASHRAE 90.1 relies on computer software for practical execution
- Traditional Florida Software
  - Energy Gauge Summit/FlaCom (www.energygauge.com)
  - Produced by Florida Solar Energy Center
  - Only Commercial Software approved for 2010 FBC
    - Also only Commercial Software that applied for approval.

EnergyGauge® Energy Analysis & Rating Software EnergyGauge Summit

C101.5.1. Compliance Materials
The Florida Building Commission shall approve specific computer software. The code official shall be permitted to approve worksheets, compliance manual and other similar materials that meet the intent of the code.

Paths from IECC C401.2

UPDATED

- Path specifics found in text of Florida Building Code, Energy Conservation, 5th Edition

2
- C402 - Envelope
- C403 - Mechanical
- C404 - SWH
- C405 - Lighting

AND

- Pick One:
  - C406.2 – Eff. HVAC Performance
  - or
  - C406.3 – Eff. Lighting Systems
  - or
  - C406.4 – On-site Renewable Energy

OR

3
- C407 – Total Building Performance
- C402.4 – Air Leakage
- C403.2 – Provisions applicable to all mechanical systems
- C404 - SWH
- Lighting Mandatory Sections
  - C405.2
  - C405.3
  - C405.4
  - C405.6
  - C405.7
- Building energy cost to be ≤ 85% of standard reference design building

Based on IECC

29

from www.energycodes.gov/becu

Common ASHRAE 90.1 Software

In addition to Energy Gauge:

NEW

- Equest
- VisualDOE
- IES
- Trace
- Energypro
- ComCheck - http://www.energycodes.gov/comcheck Free

- Before accepting, check that the version used is correct and approved by FBC
- Chapter 5 [CE] cites ASHRAE 90.1-2010

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WHAT'S COMMON?

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Structure of Code

- RE Chapters vs CE Chapters
  - RE is Residential Energy
  - CE is Commercial Energy
  - New FEC has duplicate chapters for Residential and Commercial provisions
  - Many provisions are the same, just located in a different place
- ALL Commercial Paths are found in CE chapters

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C401.2 – Prescriptive path

UPDATED

Florida Building Code, Energy Conservation, 5th Edition

- Prescriptive
- Very Rigid
- Must do provisions exactly as stated

2

- ○ C402 - Envelope
- ○ C403 - Mechanical
- ○ C404 - SWH
- ○ C405 - Lighting

AND

- ○ Pick One:
  - C406.2 – Eff. HVAC Performance
  - or
  - C406.3 – Eff. Lighting Systems
  - or
  - C406.4 – On-site Renewable Energy

Based on IECC

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from www.energycodes.gov/becu

Structure of Florida Energy Code

- Table of Contents
- Chapter 1 [CE] - Scope and Administration
- Chapter 2 {CE} - Definitions
- Chapter 3 [CE] - General Requirements
- Chapter 4 [CE] - Commercial Energy Efficiency
- Chapter 5 [CE] - Referenced Standards
- Appendix A [CE] - Reserved
- Appendix B [CE] - Calculation of End Use Energy Loads
- Appendix C [CE] - Forms
- Index [CE]

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Building Envelope Provisions
Section 402

Table C 402.2

CLIMATE ZONE	1		2	
	All Other	Group R	All Other	Group R
Insulation entirely above deck	R-20ci	R-20ci	R-20ci	R-20ci
Metal buildings (with R-5 thermal blocks)[b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci
Metal building	R-19 + R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20
Below-grade wall[d]	NR	NR	NR	NR
Mass	NR	NR	R-6.3ci	R-8.3ci
Joist/framing	NR	NR	R-30	R-30
Unheated slabs	NR	NR	NR	NR
Heated slabs[e]	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below
Swinging	U-0.61	U-0.61	U-0.61	U-0.61
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75

Table C 402.3

CLIMATE ZONE	1	2
U-factor		
Fixed fenestration	0.50	0.50
Operable fenestration	0.65	0.65
Entrance doors	1.10	0.83
SHGC		
SHGC	0.25	0.25
U-factor	0.75	0.65
SHGC	0.35	0.35

NR – No requirement.

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from www.energycodes.gov/becu

Climate Zones

Chapter CE 3 – Table C301.1

Most of Florida will be Zone 2

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from www.energycodes.gov/becu

Mechanical Systems Provisions
Section C403

Table C403.2.3(2)

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air cooled (cooling mode)	< 65,000 Btu/h	All	Split system	13.0 SEER	AHRI 210/240
			Single packaged	13.0 SEER	
	≥ 30,000 Btu/h	All	Split system	13.0 SEER	
			Single packaged	13.0 SEER	
Single-duct high-velocity air cooled	< 65,000 Btu/h	All	Split system	10.0 SEER	

This is only part CE403 to give an idea of the HVAC information contained in the Section tables.

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from www.energycodes.gov/becu

Service Water Heating
Section C404

Table C404.2
Minimum Performance of Water-Heating Equipment

✓ Water Heater Types Covered

- Electric Storage
- Gas and Oil Storage
- Instantaneous Water Heaters – Gas and Oil
- Hot water boilers – gas and oil
- Pool heaters
- Unfired storage tanks

Table C402 Example

EQUIPMENT TYPE	SIZE CATEGORY (inpuy0	SUBCATEGORY OR RATING CONDITION	Performance Required	Test Procedure
Water heaters, electric	≤ 12 kW	Resistance	0.97 – 0.00 132V, EF	DOE 10 CFR Part 430
	> 12 kW	Resistance	1.73V + 155 SI, Btu/h	ANSI Z21.10.3
	≤ 30,000 Btu/h	Heat Pump	0.93 – 0.00 132V, EF	DOE 10 CFR Part 430
Storage water heaters, gas	≤ 75,000 Btu/h	≥ 20 gal	S0.67 – 0.0019V, EF	DOE 10 CFR Part 430

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from www.energycodes.gov/becu

Applications - Prescriptive

2

- Good for very simple, small projects
- Good for remodels, change of use/occupancy
  - Applies only to provision changed
  - CE Appendix C contains Submittal Form
- Least common for new Florida Compliance

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Lighting System Provisions
Sect*ion C405*

Lighting Power Density Requirements
Table C405.5.2(1)

Building Area Type	LPD (w/ft²)
Automotive facility	0.9
Convention center	1.2
Courthouse	1.2
Dining: bar lounge/leisure	1.3
Dining: cafeteria/fast food	1.4
Dining: family	1.6
Dormitory	1.0
Exercise center	1.0
Fire station	0.8
Gymnasium	1.1

(partial table)

38

from www.energycodes.gov/becu

Total Building Performance
Section C407

UPDATED

Florida Building Code, Energy Conservation, 5th Edition

3

- Most 'New' of Compliance Paths
- Yet, not so new
  ≈ ASHRAE 90.1's approach
  – Two sections
    - Mandatory sections must be met
    - Energy "budget" must be met
- At accreditation time, field application is unknown

- **C407 – Total Building Performance**
- **C402.4 – Air Leakage**
- **C403.2 – Provisions applicable to all mechanical systems**
- **C404 - SWH**
- **Lighting Mandatory Sections**
  - **C405.2**
  - **C405.3**
  - **C405.4**
  - **C405.6**
  - **C405.7**
- **Building energy cost to be ≤ 85% of standard reference design building**

41

from www.energycodes.gov/becu

Additional Efficiency Package Options
Section *C406*

- One additional efficiency feature must be selected to comply with the FEC
  – More efficient lighting system (consistent with 90.1-2010), **OR**
  – More efficient HVAC system, **OR**
  – Installation of onsite renewables
    - 3% of the regulated energy

High Efficiency HVAC

More Efficient Lighting System

Onsite Renewables

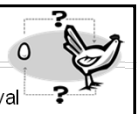
39

from www.energycodes.gov/becu

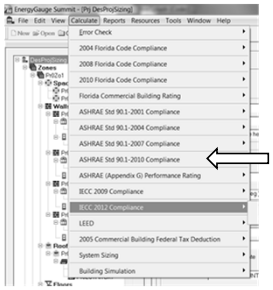
What has to come first?

- Florida Energy Code has Florida specific amendments
- Therefore using unamended 2012 IECC software to analyze FEC impacts is imperfect, not necessarily close enough to make decisions on
- Florida Building Code expected to be officially approved January 5, 2015
- Software approval depends on FBC schedule

What has to come first?



- FSEC intends to submit for software approval as quickly after January 5th as allowed
- Approval schedule also applies to ASHRAE
  - BUT ASHRAE has no edits so using 2010 (though unapproved) software to analyze impact is closer to reality



Evaluation

- Thank you

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Applications – Total Building Performance

3

- Somewhere between ASHRAE and Prescriptive
- Smaller projects that need some flexibility
- Mid-size projects that aren't overly complex

VOLUNTARY: LEARNING OBJECTIVES REVISITED

47

C401.2

UPDATED

Florida Building Code, Energy Conservation, 5th Edition

1

○ ANSI/ASHRAE/ IESNA 90.1-2010

OR

2

○ C402 - Envelope
○ C403 - Mechanical
○ C404 - SWH
○ C405 - Lighting

AND

○ Pick One:
- C406.2 – Eff. HVAC Performance
- or
- C406.3 – Eff. Lighting Systems
- or
- C406.4 – On-site Renewable Energy

OR

3

○ C407 – Total Building Performance
○ C402.4 – Air Leakage
○ C403.2 – Provisions applicable to all mechanical systems
○ C404 - SWH
○ Lighting Mandatory Sections
  - C405.2
  - C405.3
  - C405.4
  - C405.6
  - C405.7
○ Building energy cost to be ≤ 85% of standard reference design building

Based on

45

from www.energycodes.gov/becu

Course Objective Quiz

- Test your knowledge: 4 question quiz
- 3 minutes to answer questions
- Review as a group

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2014 Advanced Compliance Paths Overview
Florida Building Code, Energy Conservation 5th Edition (2014)
for Commercial Applications

LEARNING OBJECTIVES REVISITED: QUIZ

Question 1: True or False: All computer compliance software must be approved by the Florida Building Commission.

True False

Question 2: What version of ASHRAE 90.1 is allowed by reference?

Question 3: In what section is the newest compliance path (one that allows flexibility in compliance) of the Florida Energy Code found?

Question 4: For the prescriptive path, name three of the four required building systems and one optional system.

2014 Advanced Mandatory Provisions

Florida Building Code, Energy Conservation 5th Edition (2014) for Commercial Applications

Presented by The Florida Home Builders Association and the Building Officials Association of Florida Provider #0004764

1

Rules for the Day

- **Be respectful of others**
- **Keep the chatter down**
- **Be sure you have signed the sign-in sheet**

Most Important Rule

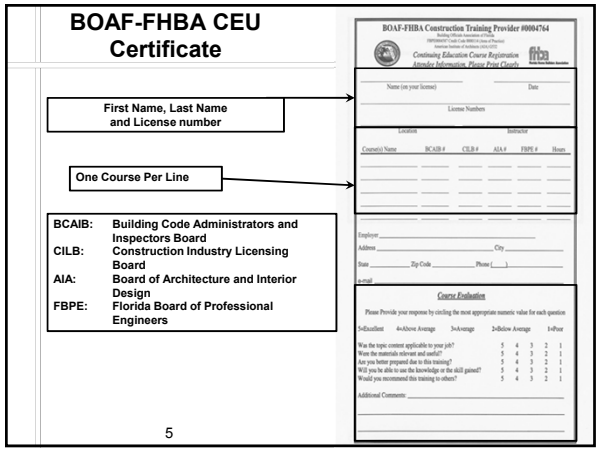
Don't throw anything at the instructor !

4

Training Presented as a Result of a Grant from: Florida Department of Business and Professional Regulation to Building a Safer Florida, Inc.

2

BOAF-FHBA CEU Certificate


First Name, Last Name and License number
One Course Per Line
BCAIB: Building Code Administrators and Inspectors Board
CILB: Construction Industry Licensing Board
AIA: Board of Architecture and Interior Design
FBPE: Florida Board of Professional Engineers
BOAF-FHBA Construction Training Provider #0004764
Continuing Education Course Registration
Attendee Information. Please Print Clearly

5

Rules for the Day

- **Cell phones OFF or on vibrate.**
- **You MUST be here to get credit; maximum out of class time permitted is 10 minutes per hour**
- **Leave your CEU certificate with the room monitor**
- **Please DO NOT read the paper or use your laptop for any purpose other than this training program.**

3

Course Title: 2014 Advanced Mandatory Provisions
Florida Building Code, Energy Conservation,
5th Edition (2014) for Commercial Applications

Date: **Location:**
Hours: 1.0 hours **Instructors:**

Approval Numbers

Contractors:	**CILB #**
Building Dept.:	**BCAIB #**
Engineers:	**FBPE**
Architects:	**AIA #**

6

The Basics

- Trainer Introduction
- Training Presenter
- Participant Poll
  - Contractors
  - Trades
  - "Boots on the ground"
  - Enforcement Officials

7

Applicability

- Buildings Other Than:
  - –One- and two-family residential
  - –R-2, R-3, R-4 three stories or less in height
    - R-2 is occupancies containing more than 2 dwelling units where the occupants are primarily permanent in nature, including apartments, boarding houses, dormitories, etc (but not hotels/motels).
    - R-3 includes one- and two-family dwellings.
    - R-4 includes residential care and assisted living facilities.

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from www.energycodes.gov/becu

BUILDING ENERGY CODES UNIVERSITY

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Many Thanks for providing technical support and slides for this module

PNNL-SA-82405

Applicability

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from www.energycodes.gov/becu

Effective Date

- Previous Code: 2010 Florida Building Code, Energy Conservation
  - Effective Date: March 15, 2012
- New Code: Florida Building Code, Energy Conservation, 5th Edition (2014)
  - Tentative Effective Date: June 30, 2015
    (as of accreditation date)

One size does not fit all

- Huge variability within Commercial construction
  - Building Types
  - Occupancies
  - Usages
- Commercial Energy Code reflect variability
  - = flexibility
  - ≈ multiple compliance options
  - ≈ confusion

ONLY Florida Energy Code…

Florida Building Code, Energy Conservation, 5th Edition

1 ○ ANSI/ASHRAE/IESNA 90.1-2010

By reference in CE Index
Provisions are contained in a separate Volume

OR

2
- ○ C402 - Envelope
- ○ C403 - Mechanical
- ○ C404 - SWH
- ○ C405 - Lighting

AND

- ○ Pick One:
  - C406.2 – Eff. HVAC Performance
  - or
  - C406.3 – Eff. Lighting Systems
  - or
  - C406.4 – On-site Renewable Energy

Based on

OR

3
- ○ C407 – Total Building Performance
- ○ C402.4 – Air Leakage
- ○ C403.2 – Provisions applicable to all mechanical systems
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  - C405.3
  - C405.4
  - C405.6
  - C405.7
- ○ Building energy cost to be ≤ 85% of standard reference design building

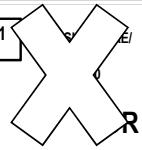
13

from www.energycodes.gov/becu

ONLY Florida Energy Code…

Florida Building Code, Energy Conservation, 5th Edition

1 ○ ANSI/ASHRAE/IESNA 90.1-2010



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from www.energycodes.gov/becu

Agenda

- We won't talk about…
  - Specific R-values, U-factors, SEER, EF
  - There is an alternative to almost every rule
  - Seven compliance paths are covered in separate BOAF/FHBA course
  - Mandatory provisions found in ASHRAE 90.1-2010
    - (though many are identical or very similar)

- What we will talk about…
  - Mandatory provisions that are common to the two paths listed in the FEC
  - Where to find them in the FEC Text

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Course Objectives

- Demonstrate ability to navigate the 2014 Florida Building Code, Energy Conservation for Commercial Applications
- Review common building envelope, mechanical and lighting provisions that apply to compliance paths found in the 2014 Florida Building Code, Energy Conservation
- Delineate where to find provisions in the text

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What's common?

- Sections that apply to Prescriptive, Total Building Performance AND Remodeling (when altered)
  - Building Envelope
  - Mechanical
  - Service hot water
  - Lighting

C.401.2 Application. (excerpted) *Commercial buildings shall comply with one of the following:…*

2. *The requirements of Sections C402, C403, C404 and C405.*
3. *The requirements of Section C407, C402.4, C403.2, C404, C405.2, C405.3, C405.4, C405.6 and C405.7*

C401.2.1 Application to existing buildings. Additions, alternations and repairs to existing buildings shall comply with one of the following:

1. *Sections C402,C403, C404 and C405..*

Common Mandatory Provisions

- C402.4 Air leakage
- C403.2 Mechanical Systems
  - C403.2.1-11
- C404 Service Water Heating
- C405.2 Lighting Controls
- C405.3 Tandem wiring
- C405.4 Exit Signs
- C405.6 Exterior Lighting
- C405.7 Electrical Power

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C402.2 Mandatory Air Leakage Requirements

- Air barriers
- Fenestration air leakage
- Air intakes, exhaust openings, stairways and shafts
- Loading dock weatherseals
- Vestibules
- Recessed lighting

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from www.energycodes.gov/becu

Difference in Definitions

- Air Barrier
- Continuous Air Barrier

- C402.4 - Mandatory
- C402.4.1 – Continuous Air Barrier
- Not applicable for Zones 1 and 2
- C402.4.2 – Air Barrier
- No exception

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from www.energycodes.gov/becu

Air Barriers and Construction C402.4.1

•2015 Code

Continuous air barrier required except in:
- Climate Zones 1-3
- Climate Zone has been expanded

Thanks to Jim Larsen, Cardinal Glass Industries

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Air leakage of fenestration C402.4.3

- Meet provision of Table C402.4.3
- Exceptions:
  - Field-fabricated fenestration assemblies that are sealed in accordance with C402.4.1
  - Fenestration in buildings that comply with Section C402.4.1.2.3 are not required to meet air leakage requirements in Table C402.4.3

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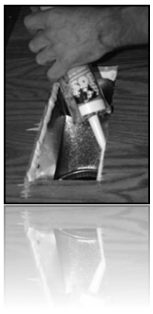
from www.energycodes.gov/becu

Air Barrier Penetrations
C402.4.2

- Penetrations of air barrier and air leakage [illegible] to be caul[illegible] gasketed, or oth[illegible]aled
- Joi[illegible]
  - –Sea[illegible] covered with a[illegible]e wrapping material
  - –Secured [illegible] required, neither is [illegible]oint for the entire sealing the penetrations
  - [illegible]ressure [illegible]nical
  - –Sealing materials appropriate for construction materials

If there is no air barrier



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from www.energycodes.gov/becu

Air Leakage of Fenestration
C402.4.3

Fenestration Assembly	cfm/ft²	Test Procedure
Windows, sliding glass doors, and swinging doors	0.20	AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400
Skylights - with condensation weepage openings	0.30	
Skylights – all other	0.20	
Curtain walls and storefront glazing	0.06	NFRC 400 or ASTM E283 at 1.57 psf
Commercial glazed swinging entrance doors	1.00	
Revolving doors	1.00	
Garage doors	0.4	ANSI/DASMA 105, NFRC 400, or ASTM E283 at 1.57 psf
Rolling doors	1.00	

Maximum is permitted to be 0.3 cfm/ft2 when tested at 6.24 psf (300 Pa)

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from www.energycodes.gov/becu

Stairway and Shaft Vents
C402.4.5.1

- To have Class I motorized dampers with maximum leakage rate of 4 cfm/ft2 at 1.0 inch water gauge (AMCA 500D standard)
- Dampers to be installed with controls to be able to open automatically upon
  - –Activation of any fire alarm initiating device of building's fire alarm system or
  - –Interruption of power to the damper

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from www.energycodes.gov/becu

Loading Dock Weatherseals
C402.4.6

- ✓Equip cargo doors and loading dock doors with weatherseals
- ✓Goal is to restrict infiltration

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from www.energycodes.gov/becu

Outdoor Air Intakes and Exhausts
C402.4.5.2

Buildings ≥ 3 stories in height above grade

- ✓ Class IA motorized leakage-rated damper
  - – Maximum leakage rate ≤ 4cfm /ft² @ 1.0 inch w.g.

Buildings of any height in Zones 1-3

- ✓ Gravity (nonmotorized) with maximum leakage rate of 20 cfm/ft² at 1.0 inch water gauge allowed
  - ✓ ***For ventilation air intakes and exhaust and relief dampers***
  - ✓ Where design outdoor air intake or exhaust capacity is < 300 cfm
- ✓ Dampers < 24 inches in either dimension may have a leakage of 40 cfm/ft² at 1.0 inch water gauge

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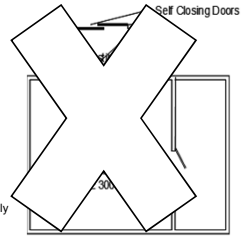
from www.energycodes.gov/becu

Vestibules
C402.4.7

- Required to reduce infiltration into spaces
- Required on entrance doors leading into spaces ≥ 3,000 ft2
- Doors must have self-closing devices
- Exceptions
  - –Buildings in Climate Zones 1 and 2
    - – Doors from a sleeping unit or dwelling unit
    - – Revolving doors
    - – Doors not intended for public use or intended solely for employee use



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from www.energycodes.gov/becu

Controls (Mandatory)
C403.2.4.4 Shutoff Dampers

Allowance for Gravity Damper is cross referenced under Section C403 – HVAC controls

- ✓**Exceptions**
  - •Gravity dampers permitted for buildings of any height located in Climate Zones 1-3

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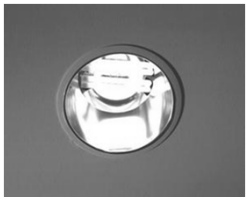
from www.energycodes.gov/becu

Recessed Lighting
C402.4.8

- All recessed luminaires installed in the building envelope sealed to limit air leakage between conditioned and unconditioned space
  - ✓ Type IC rated and sealed with gasket or caulk between housing and interior wall or ceiling covering
  - ✓ Type IC rated and labeled as having not more than 2.0 cfm when tested in accordance with ASTM E 283 at ≤ 1.57 psf (75 pa) of air movement between conditioned and unconditioned spaces



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from www.energycodes.gov/becu

Building Cavities C402.4.9 Florida specific

- Vented Dropped Ceiling Cavities
- Unvented Dropped Ceiling Cavities
- Separate tenancies
- Air Distribution system components

31

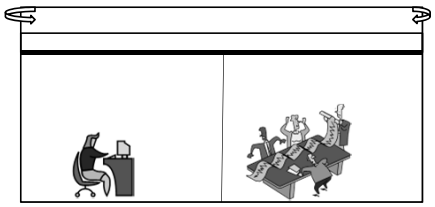
Air Barrier Definition C202

- In general, air barriers are made of durable, non-porous materials and are sealed to adjoining wall, ceiling or floor surface with a suitable long-life mastic
- House wraps and tape and sealed drywall may constitute an air barrier but dropped acoustical tile ceiling (T-bar ceilings) may not.
- Batt insulation facings and asphalt-impregnated fiberboard and felt paper are not considered air barriers.

34

Vented dropped ceiling cavities C402.4.9.1

- When over conditioned spaces, ceilings are both upper thermal envelope and pressure envelope
- Requires a continuous air barrier between conditioned space and vented unconditioned space



Unvented dropped ceiling cavities C402.4.9.2

- Where unvented dropped ceiling cavities occur over conditioned spaces that do not have an air barrier between the conditioned and unconditioned space (such as T-bar ceilings), they shall be completely sealed from the exterior environment (at the roof plane) and adjacent spaces by a continuous air barrier that is also sealed to the air barrier of the walls
- In that case, the roof assembly shall constitute both the upper thermal envelope and pressure envelope of the building

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C202 Air Barrier Definition

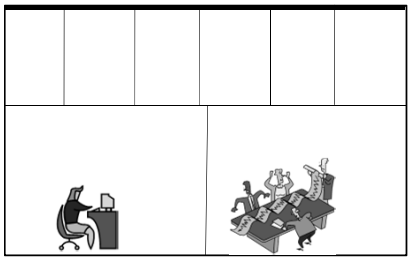
- As relates to building envelope

  comprise planes of primary resistance to air flow between the interior spaces of a building and the outdoor and

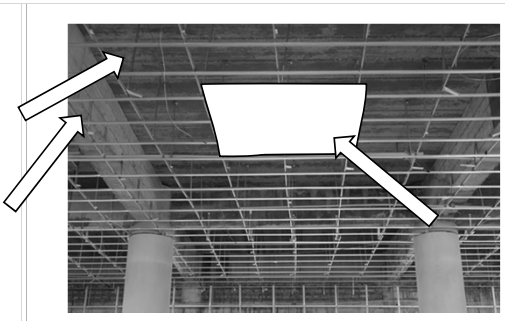
  the planes of primary air flow resistance between adjacent air zones of a building, including planes between adjacent conditioned and unconditioned air spaces of a building.
- To be classified as an air barrier, a building plane must be substantially leak free
  - Air leakage rate not greater than 0.5 cfm/ft2 when subjected to an air pressure gradient of 25 pascals

Unvented dropped ceiling cavities C402.4.9.2

- T-bar ceilings



Change of occupancy?



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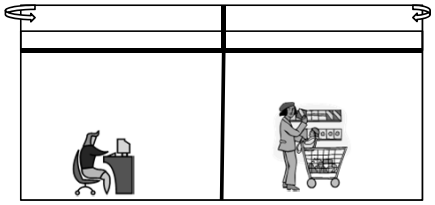
Separate tenancies
C402.4.9.3

- Unconditioned spaces above separate tenancies shall contain dividing partitions between the tenancies to form a continuous air barrier that is sealed at the ceiling and roof to prevent air flow between them



38

Air distribution system components
C402.4.9.4

- Building cavities designed to be air distribution system components shall be sealed according to the criteria for air ducts, plenums, etc. in Section 403.2.7

39

Return plenums
Table C403.2.7.2

- Building cavities which will be used a return air plenums shall be lined with a continuous air barrier made of durable nonporous materials. All penetrations to the air barrier shall be sealed with a suitable long life mastic material
- Exception: Surfaces between the plenum and conditioned spaces from which the return/mixed air is drawn.
- Roof decks above building cavities used as a return air plenum shall be insulated to at least R-19

40

Cavities in the Building Structure
C403.2.7.4

- Cavities in framed spaces, such as dropped soffits and walls, shall not be used to deliver air from or return air to the conditioning system unless they contain an air duct insert which is insulated in accordance with Section C403.2.7.1 and constructed and sealed in accordance with the requirements of Section C403.2.7.2 appropriate for the duct materials used.
- Exception: Return air plenums beneath a roof deck that is insulated to at least R-19.

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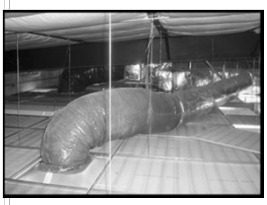
Sealing, general
C403.2.7.3

All ducts, air handlers, filter boxes, building cavities, mechanical closets and enclosed support platforms that form primary air containment passageways for air distributions shall be sealed…



Exceptions

- ✓ When located within equipment
- ✓ When design temperature difference between interior and exterior of the duct or plenum doesn't exceed 15ºF

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2014 Advanced Mandatory Air Sealing Provisions
Florida Building Code, Energy Conservation 5th Edition (2014)
for Commercial Applications

LEARNING OBJECTIVES REVISITED: QUIZ

Question 1: True or False: Air leakage provisions only apply to air distribution systems.

True False

Question 2: What Section includes a detailed tabled on approved closure systems?

Question 3: If recessed luminaires are not labeled for ≤ 2 cfm air leakage according to ASTM 283, how must they be sealed?

Question 4: On T-bar ceiling systems, what shall constitute both the upper thermal envelope and pressure envelope of the building?

Florida Energy Code V5
What's New and Noteworthy
Part 1

Presented by
The Florida Home Builders Association
and the
Building Officials Association of Florida
Provider #0004764

1

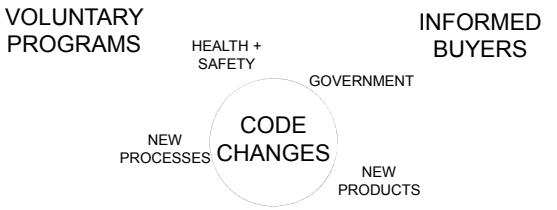
Training Presented as
a Result of a Grant from:
Florida Department of Business and
Professional Regulation
to Building a Safer Florida, Inc.

2

LEARNING OBJECTIVES

- Why codes are becoming more stringent.
- Product & Process changes in their field/trade.
- Installation of new products or processes.
- Benefits of product, process and performance changes.

3



4

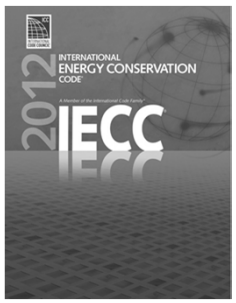
Code Dates

- Previous Code: 2010 Florida Building Code, Energy Conservation
  - Effective Date: March 15, 2012
- New Code: Florida Building Code, Energy Conservation, 5th Edition (2014)
  - Effective Date: June 30, 2015

5

Code Base

- New Version: based on the 2012 IECC
- New Version: Florida-specific amendments
- Separate sections for commercial and residential buildings.



6

Structure of Residential Chapters [RE]

- Table of Contents
- Chapter 1 [RE] - Scope and Administration
- Chapter 2 [RE] - Definitions
- Chapter 3 [RE] - General Requirements
- Chapter 4 [RE] - Residential Energy Efficiency
- Chapter 5 [RE] - Referenced Standards
- Appendix A [RE] - Reserved
- Appendix B [RE] - Calculation of End Use Energy Loads
- Appendix C [RE] - Forms
- Index [RE]

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Structure of Florida Energy Code [CE]

- Table of Contents
- Chapter 1 [CE] - Scope and Administration
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- Index [CE]

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Structure of ASHRAE 90.1-2010 – No edits

- Section 1 - Purpose
- Section 2 - Scope
- Section 3 - Definitions, Abbreviations, and Acronyms
- Section 4 - Administration and Enforcement
- Section 5 - Building Envelope
- Section 6 - Heating, Ventilating, and Air Conditioning
- Section 7 - Service Water Heating
- Section 8 – Power (Not In the IECC)
- Section 9 - Lighting
- Section 10 - Other Equipment
- Section 11 - Energy Cost Budget Method
- Section 12 - Normative References

9

Products vs. Process

Major changes to construction standards can be separated into two categories:

- PRODUCT CHANGES
- PROCESS CHANGES
  - PERFORMANCE TESTING

10

Product Changes

11

30% Rule Has New Clarification

- Florida statute – Energy Code does not apply to Renovated Buildings where changes are less than 30% of the assessed value of the building
- Staff interpretation = all changes
  - Replacements, remodels, retrofits
- 2012 – Lots of debate, DEC statements, etc.
  - System versus components
  - Renovated building vs renovation

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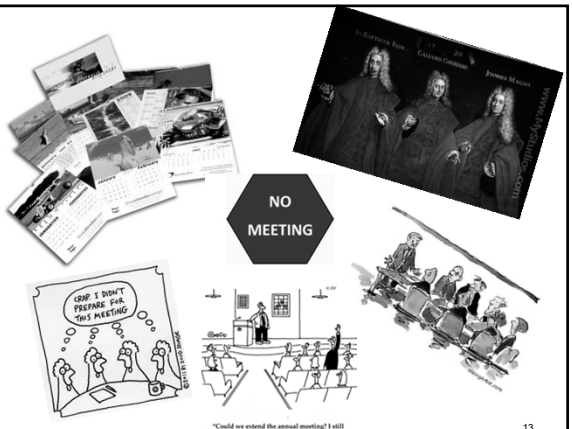

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Clarifying Language

Building systems and components. Thermal efficiency standards are set for the following building systems and components where new products are installed or replaced in existing buildings, and for which a permit must be obtained. New products shall meet the minimum efficiencies allowed by this code for the following systems and components:

- Heating, ventilating or air conditioning systems;
- Service water or pool heating systems;
- Electrical systems and motors;
- Lighting systems.
- Replacement Fenestration.

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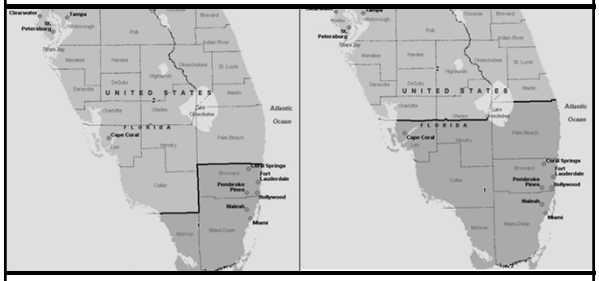
Expanded Climate Zone 1

- Current
- 2015 Code



Thanks to Jim Larsen, Cardinal Glass Industries

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Residential Window Changes

- Current

Zone 2
- U = 0.65
  - 0.75 for impact
- SHGC = 0.30

Zone 1
- U= 0.65
  - 0.75 for impact
- SHGC = 0.30

- 2015

Zone 2
- **U = 0.40**
  - **0.65** for impact
- **SHGC = 0.25**

Zone 1 (bigger zone)
- U= 0.65
  - 0.75 for impact
- **SHGC = 0.25**

Thanks to Jim Larsen, Cardinal Glass Industries 16

Commercial Window Changes

Current (Metal, all other)

Zone 2
- U = 0.75
- SHGC = 0.25

Zone 1
- U= 1.20
- SHGC = 0.25

2015

Fixed: Zones 1 & 2
- **U = 0.50**
- SHGC = 0.25

Operable: Zones 1 & 2
- **U= 0.65**
- SHGC = 0.25

Thanks to Jim Larsen, Cardinal Glass Industries 17

Updated Requirements

- R404.1 Lighting equipment
  - 2010 code: 50% of lamps were required to be high-efficacy.
  - New code: 75% of lamps were required to be high-efficacy.
- R404.1.1 Lighting equipment
  - Previously only for pool heaters

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New Requirements

- R403.2.2.1 Sealed air handler

R403.2.2.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

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Process Changes

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Commercial Energy Code

- Picks up IECC compliance paths
- Prescriptive – applies well for retrofits and remodels (2 Paths)
- Performance (5 Paths)
- Also ASHRAE 90.1
  - 2007 ⟶ 2010
  - By reference
  - No edits for Florida

New Processes

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Performance Testing

22

R402.4 Air leakage (Mandatory)

- Blower door test and visual inspection as required by local code. Building envelope tightness must be less than the following performance measurement:
  - **Climate Zones 1-2: 5 ACH @ 50**

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Establish the Air Barrier

The first and most important step to building a high performance home is creating an air barrier that is:

- Clearly ***Defined*** and ***Continuous***
- ***Complete*** to Protect Insulation
- In ***Contact*** with the Thermal Barrier

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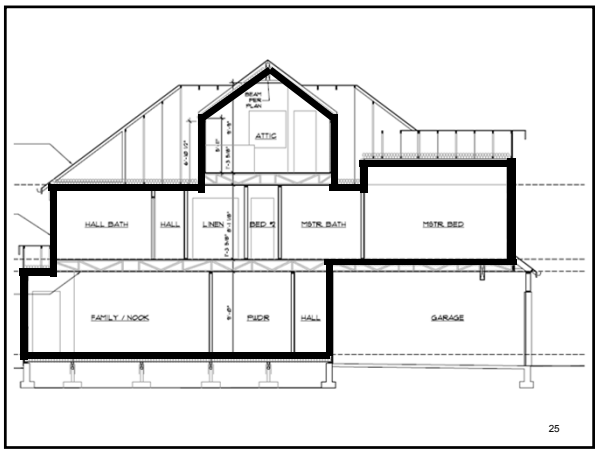

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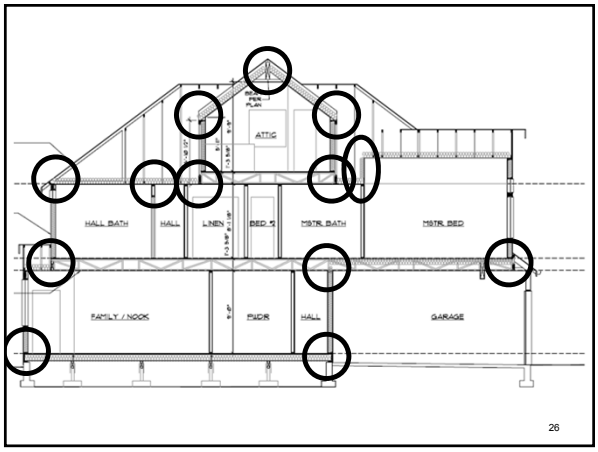

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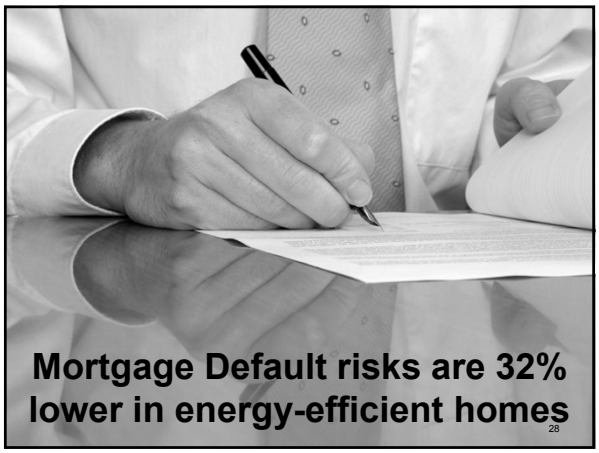
Backing, Blocking & Caulking

5 Critical Areas

- **Concealed Areas:**
  - Rigid backing behind tubs, showers and fireplaces
  - Backed knee walls and skylights
- **Completely separate conditioned and unconditioned space:**
  - Garage to house
  - Rim/band between 2 stories
  - Floors connected to attics
- **Full depth insulation:**
  - Attic platforms
  - Attic access
  - Knee walls and skylights
  - Common walls
- **Air seal all gaps in ceilings and floors:**
  - Attic and crawl hatches
  - Supply boots, return boxes & exhaust fans
  - Can lights, speakers, smoke alarms, sprinklers, etc.



Mortgage Default risks are 32% lower in energy-efficient homes

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Residential

- Acceptable Indoor Air Quality Defined:
  - ASHRAE 62.2 - 2010)
- Air toward which a substantial majority of occupants express no dissatisfaction with respect to odor and sensory irritation and in which there are not likely to be contaminants at concentrations that are known to pose a health risk

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Pros and Cons of Various Mechanical Ventilation Systems

Ventilation Type	Pros	Cons
Exhaust Only (air is exhausted from the house with a fan)	• Easy to install • Simple method for spot ventilation • Inexpensive	• Negative pressure may cause backdrafting • Makeup air is from random sources • Removes heated or cooled air
Supply Only (air is supplied into the house with a fan)	• Does not interfere with combustion appliances • Positive pressures inhibit pollutants from entering • Delivers to important locations	• Does not remove indoor air pollutants at their source • Brings in hot or cold air or moisture from outside • Air circulation can feel drafty • Furnace fan runs more often unless fan has an ECM (variable-speed motor)
Balanced Air Exchange System (heat and energy recovery ventilators)	• No combustion impact • No induced infiltration/exfiltration • Can be regulated to optimize performance • Provides equal supply and exhaust air • Recovers up to 80% of the energy in air exchanged	• More complicated design considerations • Over ventilation unless the building is tight • Cost

Whole House Mechanical Ventilation Options

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Questions?
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